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ABSTRACT

This is the first issue in a series of reports on a national survey conducted to determine the number and primary uses of microcomputers in schools. The survey sample consisted of 2,209 public, private, and parochial elementary and secondary schools in the United States. Findings of the survey (conducted in 1982/83 by means of mailed questionnaires and telephone contact to the schools) indicate that: (1) secondary schools are the largest pre-college users of microcomputers, with emphasis on the teaching of BASIC language programming; (2) 53 percent of schools now have at least one microcomputer for student instruction; (3) the use of microcomputers is growing faster in secondary schools than in elementary schools; (4) elementary schools tend to have only cassette-based microcomputer equipment; (5) small parochial elementary schools and public schools in poorer districts are less likely to have microcomputers; (6) microcomputers are used for both drill-and-practice and for programming instruction, with greater emphasis placed on drill-and-practice by elementary schools and on programmming instruction by secondary schools; (7) social effects outweigh the academic effects of microcomputers; and (8) above-average students benefit more than average or below-average students from the use of microcomputers. (AOS)

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School Uses of Microcomputers

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School Uses of Microcomputers

Reports from a National Survey

Issue No. 1, April 1983

Center for Social Organization of Schools The Johns Hopkins University

Introduction

This report is the first of a series to be issued over the next few months from the National Survey of School Uses of Microcomputers. These reports will provide preliminary findings from the survey. This issue describes the sample of schools used in the survey, presents the initial results about the number and primary uses of microcomputers in schools today, and introduces some of the topics that will be covered in greater detail in upcoming issues.

Specific percentages shown in these reports are preliminary. Late-arriving questionnaires and additional "editing" of data files may result in slight changes to percentages shown in the tables and figures. However, the additional work is unlikely to change any of the tendencies or relationships that the tables and figures illustrate and that are discussed in the text.

The 2,209 Schools in the National Sample

This study is based on a probability sample of 2,209 public, private, and parochial elementary and secondary schools in the United States. The sample was constructed from a sampling frame of all public schools and over 90% of the private and parochial schools in the U.S. provided by Quality Education Data of Denver, Colorado.

A stratified sampling design was employed, oversampling certain categories of schools in order to obtain the greatest detailed information about schools likely to have had the most experience with microcomputers, and to obtain a sufficient number of cases from non-public schools to enable analysis of the use of microcomputers in that sector. However, all of the reported data reflect a "reweighting" of the raw results so that the reported results may be intepreted as coming from a representative sample of all schools in the United States.

Response Rate: Information about whether a sampled school had a microcomputer, and how many it had, was obtained for 96% of the national sample. This was accomplished between December, 1982 and February, 1983 by means of mailed questionnaires to the principal and a telephone contact to the school.

The remaining information about microcomputer-using schools was provided by a teacher at the school identified as the "primary computer-using teacher." To date, April 7th, we have received 1076 completed 18-page questionnaires from these computer-using teachers. These returned booklets represent 68% of the schools in the sample that have one or more microcomputers obtained for use in their instructional program.

Although additional surveys are still being received, the results in this first report reflect the 990 responses obtained by March 11th.

The effort contributed by school principals and teachers cannot be

overstated. Without their interest in seeing that objective information about microcomputers and schools be provided for their own and other's use, this survey would not be possible.

Microcomputers and Schools: Basic Data from the National Survey

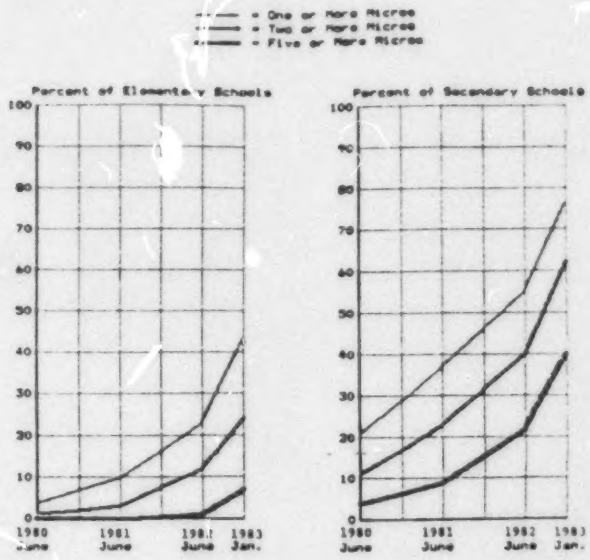
A good part of the attention being given to the use of microcomputers in schools has been in terms of their use by elementary schools to improve student achievement in basic skills. Most of the software being marketed to schools is targeted at the elementary school level and built around the premise that microcomputers can be cost-effective means of increasing the rate at which students learn rules of arithmetic computation and proper English language usage. Much of what is advertised and written about in magazines and newspapers and in specialized educational computing magazines also reflects these emphases.

Yet the evidence from our national survey of microcomputer-using schools is that secondary schools remain the largest pre-college users of microcomputers and that the overwhelming emphasis in secondary schools (and in the earliest computer-adopting elementary schools) is on teaching students about computers and how to program them using the language BASIC.

A Majority of Schools Now Have Microcomputers. By January, 1983, 53% of all schools in the United States had at least one microcomputer obtained for use in instructing students. The number of microcomputers in schools grew at an even faster rate during the latter half of 1982 than it had previously. (See Figure 1.)

As has been true over the last several years, however, schools already having a microcomputer were more likely to add to their stock than were schools without a microcomputer likely to buy one for the first time (Table 1).

Fig. 1: Microcomputers in Schools: 1980-1983



Secondary Schools Are More Likely to Have One: Secondary schools continued to dominate pre-college microcomputer ownership. By January, 1983, 85% of all high schools, 77% of all junior-senior combinations and 68% of all middle- and junior high schools had one or more microcomputers. The corresponding figure for elementary schools rose to 42% during the same period. Even the smallest secondary schools (i.e., those under 200 students) are more likely to have at least one microcomputer than are the largest elementary schools (those over 700 students).

Secondary Schools Are Becoming New Users at a Faster Rate: Between June, 1982 and January, 1983, nearly half of the secondary schools that had not previously owned a microcomputer became equipped with one. In contrast, during that period only 16% of the elementary schools that had not previously had a microcomputer joined the ranks of microcomputer-using schools. (See the rightmost column of Table 1.)

Table 1: Which Schools Obtained Micros During These Intervals?

Microcomputers Owned at Start of Interval	Percent Obtaining a Microcomputer During... July, 1980- June, 1981	July, 1981- June, 1982	July, 1982- Jan., 1983
Elementary Schools:			
Had NO Microcomputers	6%	14%	16%
Had ONE Microcomputer	6%	44%	30%
Had MORE THAN 1 Micro	*	*	51%
Secondary Schools:			
Had NO Microcomputers	20%	30%	46%
Had ONE Microcomputer	33%	35%	62%
Had MORE THAN 1 Micro	38%	49%	56%

* Too few cases to report.

Secondary Schools with Five or More Have Doubled Since June: Perhaps more significantly, the proportion of secondary schools that had five or more microcomputers nearly doubled during this period and now encompasses two-fifths of all U.S. secondary schools. Growth in multiple-microcomputer ownership was strong at the elementary school also, but starting from almost zero, it still trails secondary schools by a wide margin. (See Figure 1 for over-time comparisons of microcomputer ownership for elementary and secondary schools.)

Elementary Schools are Now Where Secondary Schools were in 1981: Although elementary schools still seem far behind secondary schools in ownership of microcomputers, they are now about where secondary schools were only two years ago. In June, 1981, only 38% of secondary schools had any microcomputers; as of January, 1983, 42% of elementary schools had one.

Many Elementary Schools Have Only Cassette-Based Micros: However, elementary schools tend to have microcomputer equipment in smaller numbers and with less capacity. For example, 37% of microcomputer-owning elementary schools do not have any micros that operate with disk drives. In contrast, only 12% of microcomputer-owning secondary schools lack disk drives for at least one of their machines. Ten percent of secondary schools with micros have their machines linked in a "network" of some kind, whereas this is true of only 1% of microcomputer-owning elementary schools.

The Least Likely Owners: Small Parochial Elementaries and Public Schools in Poorer Districts: Non-public secondary schools are about as likely to have at least one microcomputer as are public secondary schools; however, small non-public elementary schools (primarily parochial schools) are less likely than their equal-sized public counterparts to have invested in microcomputer equipment.

This survey confirms previous findings that public schools in districts with a high percentage of poor families are much less likely to be microcomputer-owning schools. For example, whereas two-thirds of public schools in the better-off districts have microcomputers, only 41% of the schools in the least wealthy districts have any.

Drill-and-Practice and Programming Instruction--Two Primary Uses

Survey respondents--selected by each principal as the "primary" computer-using teacher at the school--were asked to report how much their school's microcomputers were being used in each of several specific ways. Table 2 indicates the proportion of teachers at microcomputer-owning schools who reported "regular" or "extensive" use of microcomputers for each of twelve instructional functions. The answers of elementary school teachers are on the left and those of secondary teachers are on the right. A common scale is used so that the reader can make comparisons among functions and across types of schools.

Programming in Secondary--Drills and Programming in Elementary: Apart from general computer literacy, computer programming is the clearly preferred activity in secondary schools, while "drill-and-practice" leads programming as the most employed application of microcomputers in elementary schools.

Microcomputers are also used to assist individual students in elementary schools and in the business programs at high schools, but less frequently than either programming activities at either level or drill activities for more inclusive groups of elementary students. Demonstrations, problem-solving using programming, and recreational games are used regularly in about one-fifth of the schools with microcomputers.

Management activities such as using micros to help produce tests or worksheets, and other student activities such as word-processing, are far down the list, getting mention as a "regular" use in well under 10% of the schools.

Teaching computer programming nearly everywhere means instruction using the BASIC programming language. Of the schools which provide 30 hours or more of programming instruction to at least a few students (as do a majority of microcomputer-owning schools), 98% teach BASIC and 5% each teach using FORTRAN, LOGO, and PASCAL.

Use for Drill-and-Practice is LOWER than Teachers Anticipated: The survey asked teachers not only about current uses of microcomputers, but also about uses that were antici-

Table 2: Reported "Regular" or "Extensive" Uses of Microcomputers

(Percent of teachers reporting such usage at their school.)

ELEMENTARY	PERCENT USING FOR PURPOSE INDICATED	SECONDARY
	85%	Introduction to computers
	76%	Programming instruction
Introduction to computers	64%	
Drill-and-Practice	59%	
Programming instruction	47%	
Tutoring for special students	41%	
	31%	Drill-and-Practice
	29%	Business ed./vocational
	29%	Programming to solve problems
Programming to solve problems	27%	
Recreational games	24%	
	22%	Demonstrations, labs, simulations
Demonstrations, labs, simulations	20%	Tutoring for special students
	19%	Recreational games
	15%	Teacher record-keeping
	14%	Administrative use
Administrative use	10%	Teacher tests, worksheets
Teacher record-keeping	7%	Student papers, word-processing
Teacher tests, worksheets	5%	
Student papers, word-processing	3%	

pated at the time the school's first microcomputer was obtained. In addition, some inferences can be made by looking at differences between schools that are now in their third year of having a microcomputer and those that are in their second year or their first year. Figures 2 and 3 and Table 3 report these data.

Fig. 2: Actual Use Compared to Anticipated Use

(Schools with a Micro prior to July, 1981)

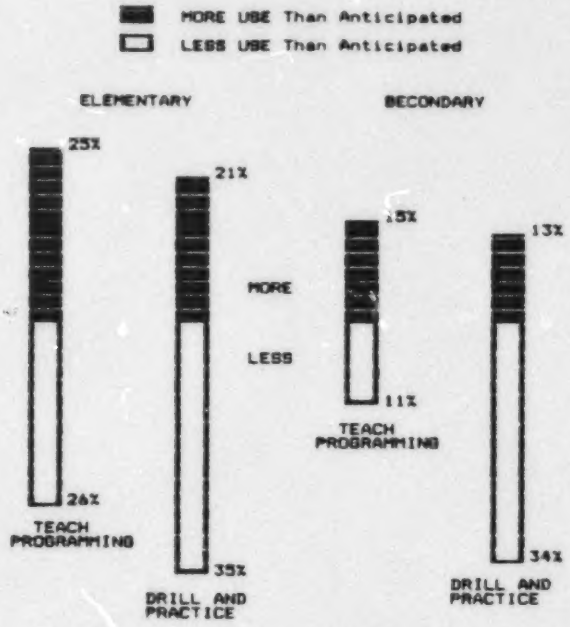


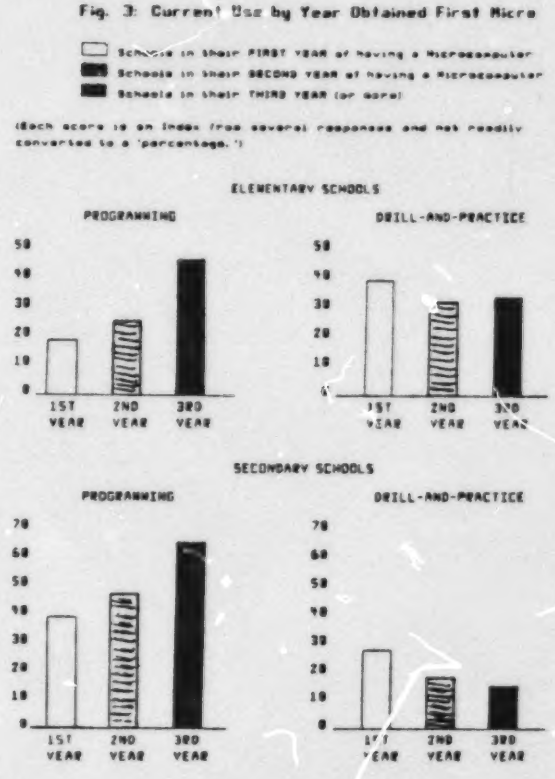
Figure 2 shows that among schools that obtained their first microcomputer before July, 1981, about the same number use their microcomputers more than they anticipated for programming instruction as use them less for programming than anticipated. However, with drill-and-practice, this is not so. A greater number of schools report a decline in the use of microcomputers for drill-and-practice than those who report an increase over their initial anticipations.

For example, among elementary schools that started with microcomputers before July, 1981, 25% are providing more instruction in programming than anticipated and 26% are providing less instruction in programming than they anticipated; 21% provide more computer drill-and-practice than anticipated, but 35% report providing less instruction this way. Corresponding changes in programming and drill uses are even more pronounced for secondary schools. (See Figure 2.)

Schools With More Micro Experience Lean Toward "Programming" Uses:
Schools that obtained their first microcomputer before July, 1981 report the most extensive use of microcomputers for providing instruction in computer programming. By itself, this is not surprising. They have had the longest period in which to organize this new area of instruction.

Looking at the different schools who today are in their first, second, or third (or more) year of having a microcomputer, there is a consistent decline in the use of microcomputers for drill-and-practice that parallels their greater experience, and a consistent increase in the use of microcomputers for instruction in

Fig. 3: Current Use by Year Obtained First Micro



programming. This is true for both elementary schools and secondary schools. (The data are shown in Figure 3, which is based on an "index" of "extent of use" questions in the survey.) Even among elementary schools, which as a group use drill-and-practice more than programming, those that obtained their first microcomputer prior to July, 1981 currently use micros more to teach computer programming than to teach traditional math and language subjects by computer-based practice.

"Tool" or "Resource"? The Most Experienced Schools Say "Resource": Similar results were found for another questionnaire item. Teachers were asked whether they view microcomputers as primarily a "tool" to help them teach basic skills or a "resource" for students to learn more about computers. They were also asked how microcomputers were viewed at the time their school got its first computer.

Table 3: Tool or Resource: Changes from Prior Expectations

(Prior expectations as reported retrospectively in survey.)

	Among those who ORIGINALLY SAID TOOL, Percent who NOW SAY RESOURCE	Among those who ORIGINALLY SAID RESOURCE, Percent who NOW SAY TOOL
Obtained Micro: Before July, 1981		
Elementary Schools.....	31%	11%
Secondary Schools.....	64%	8%
Obtained Micro: July, 1981-June, 1982		
Elementary Schools.....	30%	37%
Secondary Schools.....	41%	6%
Obtained Micro: July, 1982-Jan., 1983		
Elementary Schools.....	22%	8%
Secondary Schools.....	*	12%

* Number of cases insufficient to report.

In schools that obtained a microcomputer before July, 1981, nearly two-thirds of the secondary and one-third of the elementary teachers who said that the micro was originally viewed as a "tool" now view it as a "resource." In contrast, only about 10% of those who initially viewed it as a "resource" now consider it to be primarily a "tool." This movement toward "resource" is less apparent among schools that obtained their first microcomputer more recently. (See Table 3.)

Are Schools Changing Their Opinions with Experience? Two inferences from these results are possible at this time. After having tried both drill and programming uses, secondary schools and even elementary schools may have found it more useful to employ these machines to expand the curriculum--teaching students about computers and how to program them--than to provide another means to teach traditional subject-matter. Alternatively, it may be that the "pioneer" schools became disenchanted with the drill-and-practice software available at the time and have not ventured back to examine more recent software products which schools who more recently became microcomputer owners have been able to use at least somewhat successfully. That is, Figure 3 and Table 3 suggest a possible trend over time, but this may turn out to be a "cohort" effect rather than an accurate extrapolation to the future.

Where Is the Microcomputer Having Its Biggest Impact?

A lot has been said about microcomputers affecting students, teachers, and the whole process of schooling, but there has been relatively little scientific investigation of their impact. This national survey cannot provide that measurement either--we need well-designed studies using random assignment to treatments, reasonable alternative treatments provided to control groups, and enough cases to allow for generalizing findings to a range of schools. However, this survey does allow us to learn the views of a representative sample of microcomputer-using teachers on the effects that having a microcomputer has had on their school. Although teachers may be inclined to "overreport" the success they have had, the data shown in Figure 4 allow us to compare how these teachers believe

microcomputers have affected a number of different possible outcomes.

Teachers Say the Greatest Impact of Microcomputers Has Been Social: For the most part, microcomputer-using teachers find that the effects of microcomputers have been more on the social organization of learning than on increased student achievement per se. Substantial numbers of microcomputer-using-teachers believe that micros have led to increased student enthusiasm for schooling; to students working more independently, without assistance from teachers; to students helping one another and answering each other's questions; and to students being assigned to do work more appropriate to their achievement level. (See Figure 4.)

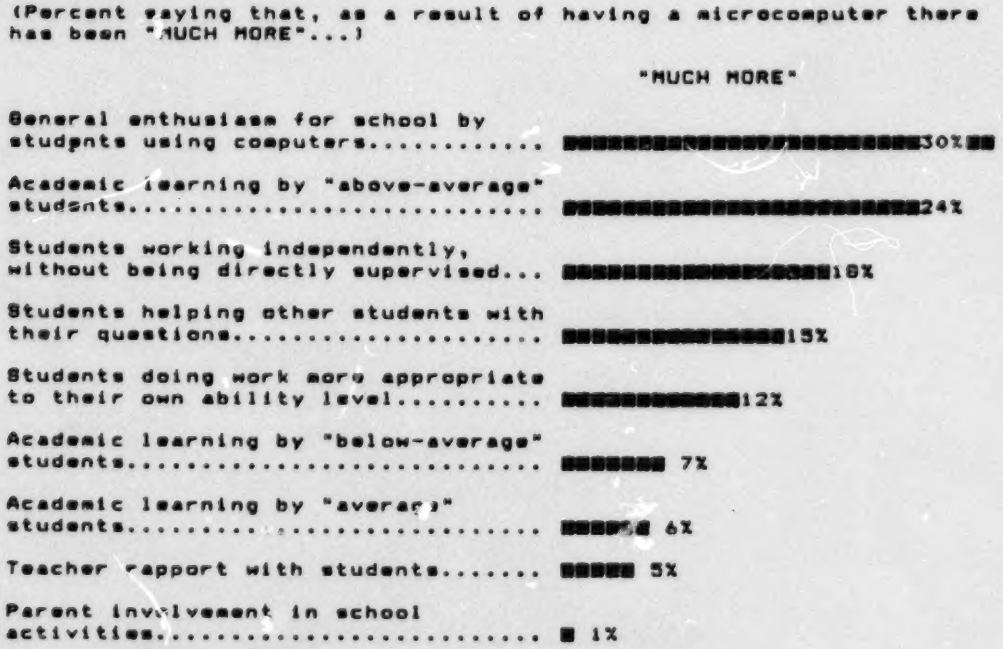
Teachers Say Above-Average Students Have Learned the Most: The microcomputer-using-teachers also believe that "above-average" students have learned more than "average" or "below-average" students from having had a microcomputer in their school. For example, 24% of the teachers said that as a result of having a microcomputer there had been "much more academic learning by above-average students." Only 6% of the teachers said that the same was true for average students and 7% said this was true for below-average students. (See Figure 4.) Teachers in elementary schools and those in secondary schools came to similar conclusions about the relative value for high-, low-, and average-achieving students, even though microcomputers are being used in characteristically different ways in the two types of schools.

Coming In Future Reports

Each report in this series will deal with some aspect of the national survey. The following are illustrative of the topics that will be covered:

* Which people have had the most important influence on their school's acquisition of microcomputers--administrators, teachers, parents, district officials, others? How important was each person at different stages in the process (pushing the idea, obtaining funds, deciding on equipment, deciding how it would be used)? Have the influence

Fig. 4: The Micro's Impact as Viewed by Teachers


(Percent saying that, as a result of having a microcomputer there has been "MUCH MORE"...)
"MUCH MORE"
General enthusiasm for school by students using computers..... 30%
Academic learning by "above-average" students..... 24%
Students working independently, without being directly supervised... 18%
Students helping other students with their questions..... 15%
Students doing work more appropriate to their own ability level..... 12%
Academic learning by "below-average" students..... 7%
Academic learning by "average" students..... 6%
Teacher rapport with students..... 5%
Parent involvement in school activities..... 1%

patterns changed over the past several years? How different are these patterns in different-sized and differently-located schools?

* How much use is being made of microcomputers--by how many students at each school, by how many teachers? How much "computer time" does each student obtain during a week and does access time differ for students at the same school using the microcomputer for different purposes? In what kinds of schools is there under-utilization of equipment?

* How do teachers deal with microcomputers in the context of organizing instruction in classroom settings? What do students do when others are using the limited number of microcomputers available? How many students work at the same microcomputer at the same time? Where are they housed in the school? Differences in social organization of the use of microcomputers will be analyzed in terms of grade level and the number of microcomputers at the school (and the number of students).

* Other topics covered in the survey may also be included in these interim reports: The kinds of microcomputer-related teacher training that are thought by computer-using-teachers to be most essential at their school; trends over time in the kinds of equipment being obtained by schools; use before and after school; rules regarding use and borrowing of equipment; programming knowledge of teachers and the amount of time teachers spend programming; help sought from various sources outside of the school and the perceived quality of help obtained from these sources; characteristics of software obtained for computer-assisted-instruction; keyboard skills of student users; teachers' opinions of the value of microcomputers like their own to assist in different kinds of instruction; estimated acquisition of microcomputer-related products over the coming year; and use of microcomputers for administrative operations.

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